Space Weather Technical Forecast

Issued on Thursday, 12 May 2022 at 01:23 Local

This technical forecast provides a four day assessment of space weather events. The probabilities stated below are for reaching or exceeding the given levels. For more information about space weather impacts please see the Met Office Space Weather Scales https://www.metoffice.gov.uk/weather/learn-about/space-weather/uk-scales

Space Weather Forecast Headline: Chance of isolated R1-R2 radio blackouts.

Analysis of Space Weather Activity over past 24 hours

Solar Activity: Solar activity has been Moderate with an M2.6 flare at 11/1859UTC which consisted of a long period flare from EX3004 from around the western hemisphere combined with a short flare from AR3007. Two CMEs have been detected from this event, one from each flare, although further computation is needed, currently no ejecta is thought to be earth directed. There are currently four numbered sunspots on the visible disk, perhaps with returning regions soon to arrive on the eastern limb. AR3006 is simplifying, losing its delta magnetic complexity and it's large umbra in the trailing region. AR3007 remains the most potent sunspot. It resides in the southeast quadrant and is continuing to develop, now with large asymmetric penumbra around the trailing region, this also exhibits a delta spot within this same area. There are two simple and small Beta-Bxo spots in the northern hemisphere, mirroring the longitudes of the larger spots to the south.

Solar Wind / Geomagnetic Activity: The solar wind as measured at L1 has been slow-ambient, though there was a distinct rise from 270-320 km/s between 11/1200-1315 UTC, likely from a weak transient. Density followed a similar pattern, with mostly above average levels and a maximum of 20ppcc at 11/1413 UTC. Total interplanetary magnetic field strength was weak, becoming moderate between 11/1240-2115 UTC and a maximum of 11nT. The Bz was also weak initially, becoming moderately negative between 11/1724-2030 UTC with a peak value of -10nT. The Phi angle has remained negative (towards the Sun) throughout. Although solar wind parameters indicate a glancing CME/transient during the second half of 11th May, due to the low speed, no significant geomagnetic activity has been achieved. Geomagnetic activity has been Quiet throughout (Kp 0-2).

Energetic Particles / Solar Radiation: The high energy proton flux (10 MeV) rose to moderate in response to the M2.6 flare from 11/1859 UTC, peaking at 5.05e0 ppcc at 11/2330 UTC. High energy electron flux (greater than 2MeV) has remained at background levels. The Electron fluence is well below the Active (1e8 integrated pfu) threshold with a mostly flat trend and a value of 1.3e6 integrated pfu observed at 12/0000UTC.

Four-Day Space Weather Forecast Summary

Solar Activity: Solar activity is likely to be Low with background C-class flares probable due to the presence of two sizable sunspot regions in the south, namely AR3007. There is a continual chance of this increasing into Moderate activity (isolated M flares). There also remains a slight chance of further X-class flares.

Solar Wind / Geomagnetic Activity: No significant enhancements are expected in solar winds in the next 4 days, though there remains an uncertain chance of activity during day 1 or 2 (12 or 13 May) due to a potential shock from the X-flare from the 10th. Therefore, geomagnetic activity is currently expected to be mainly Quiet (Kp 0-2) with isolated Unsettled (Kp3) periods.

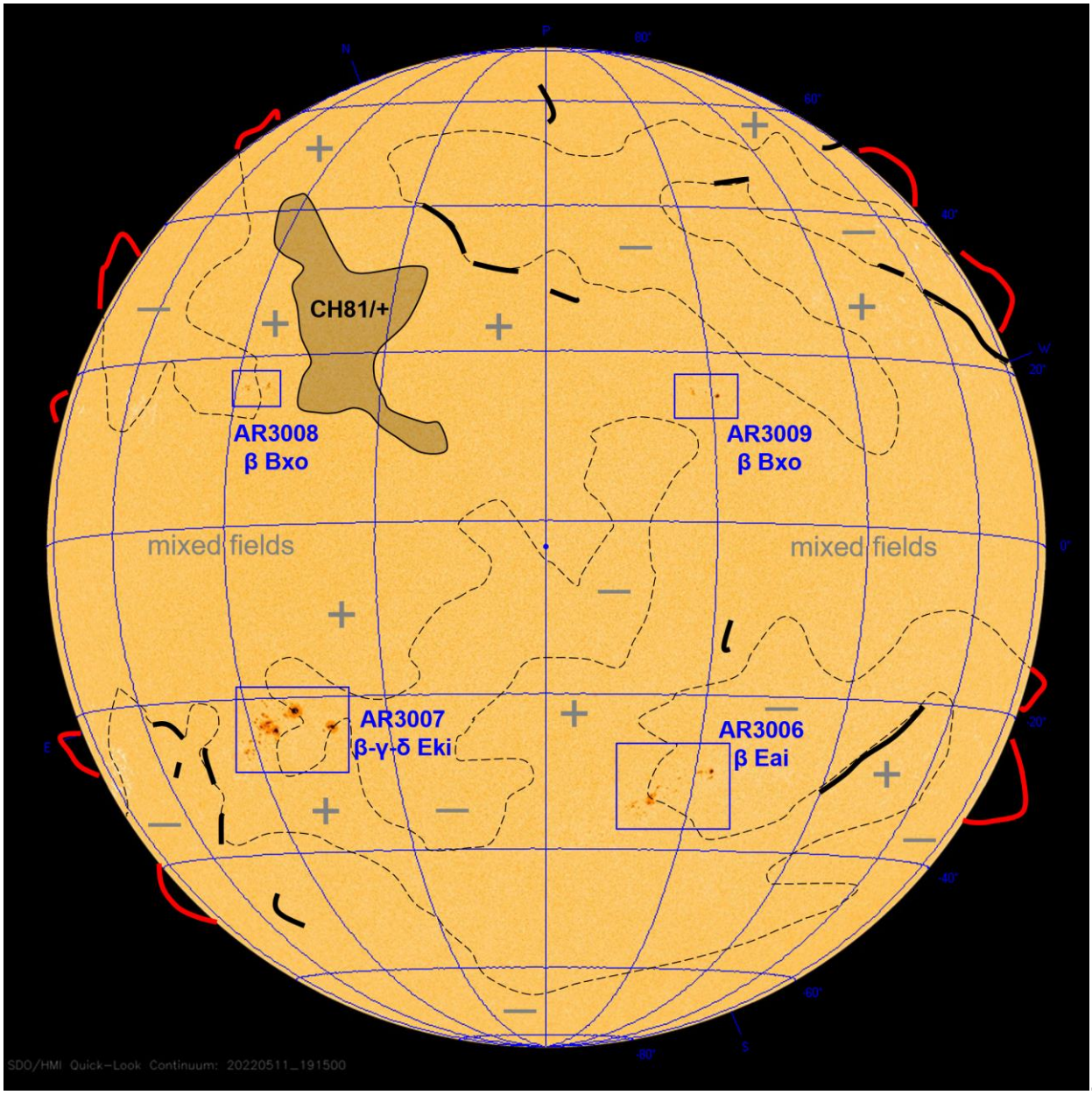
Energetic Particles / Solar Radiation: The high energy proton flux (greater than 10 MeV) is expected to start at moderate levels but fall back to background levels until AR3007 rotates into

Issued by Met Office Space Weather Advisor, Tel: +44 (0) 330 135 4254 Email: moswoc@metoffice.gov.uk

© Crown Copyright 2022. All Rights Reserved.

the western limb next week. The high energy electron flux (greater than 2MeV) is forecast to remain at normal background levels. The 24-hour electron fluence is expected to remain below the Active threshold.

Figure 1. Solar Analysis Valid 11/2000 UTC.



Key: Filament ___ , Prominence ___ , Magnetic Field Line - - - , Polarity +/-, Coronal Holes: Grey shaded area CHxx +/-, Sunspot groups 25xx - Mt Wilson α-β-βγ-βγδ and Zurich-McIntosh Axx etc.

Issued by Met Office Space Weather Advisor, Tel: +44 (0) 330 135 4254 Email: moswoc@metoffice.gov.uk

© Crown Copyright 2022. All Rights Reserved.

Geomagnetic Storms:

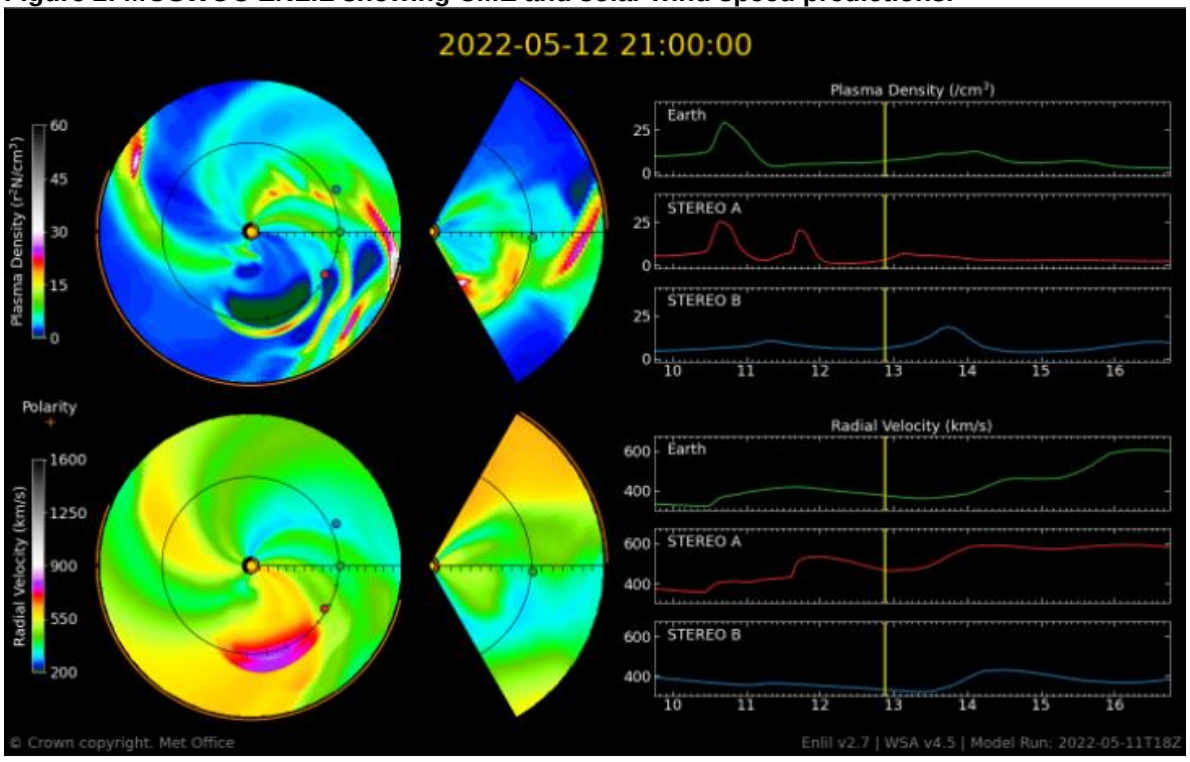
An X1.5 flare on 10 May from south-centre disc appears to have produced an asymmetric CME, combining with a long-period flare from the eastern limb. Coronagraph analysis remains inconclusive and although there is a chance of seeing a transient feature at L1 later on 12th or early 13th May, this remains unlikley, with no significant portion of this CME complex heading for Earth.

Three CME's that left the Sun on 11th May from EX3004, AR3007 and a region over the eastern limb remain to be fully analysed and computed. These may therefore feature in subsequent forecasts.

CH81/+ looks to possibly arrive after this forecast period (16th May), bringing solar wind speeds of around 500 km/s. Enlil shows an earlier arrival of this feature, perhaps in part due to CH81 being displaced further east and smaller than on the previous rotation.

Geo-Magnetic Storm Probability (Exceedance)	Level	Past 24 Hours (Yes/No)	Day 1 (00-24 UTC) (%)	Day 2 (00-24 UTC) (%)	Day 3 (00-24 UTC) (%)	Day 4 (00-24 UTC) (%)
Minor or Moderate	G1 to G2	No	5	5	2	2
Strong	G3	No	1	1	1	1
Severe	G4	No	1	1	1	1
Extreme	G5	No	1	1	1	1

Figure 2: MOSWOC ENLIL showing CME and solar wind speed predictions.



Issued by Met Office Space Weather Advisor, Tel: +44 (0) 330 135 4254 Email: moswoc@metoffice.gov.uk

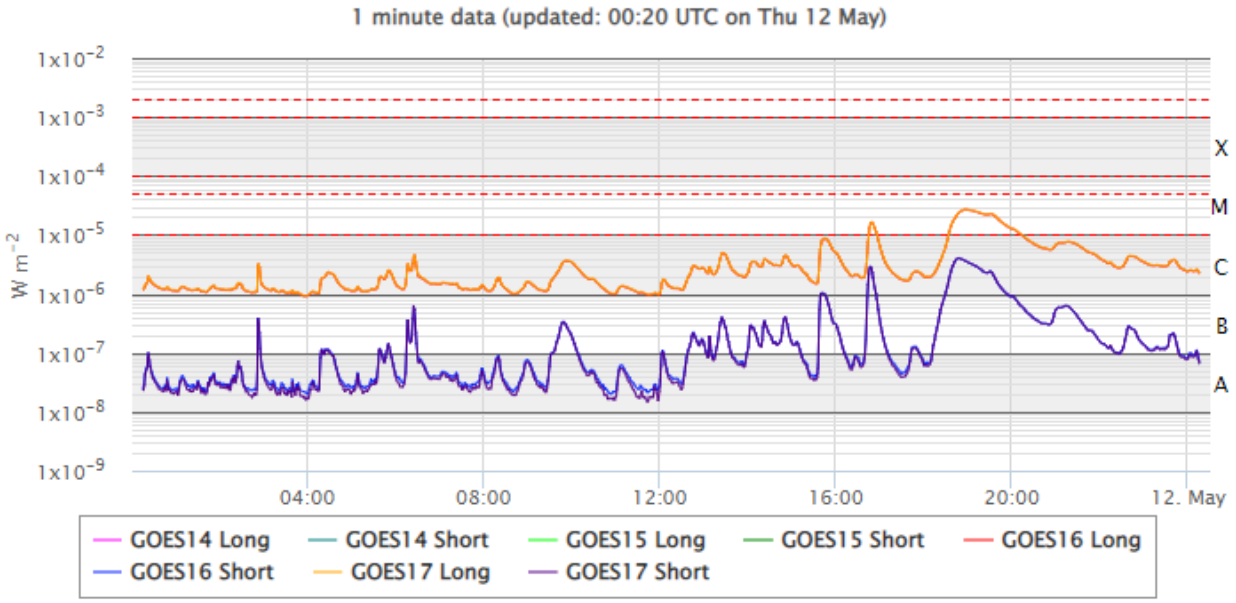
© Crown Copyright 2022. All Rights Reserved.

Radio Blackouts - X-Ray Flares:

Solar activity was Moderate in the past 24 hours. The most recent significant flare of the period was an M2.6 peaking at 11/1859 UTC, originating from EX3004, which left the visible disk around the western limb approx 36 hours ago. A flare was also recorded at AR3007 during the same period. There remains a chance of further M-class flares, these most probably originating from AR3007, which now has a delta spot and large asymmetric penumbra. There also remains a slight chance of an isolated X-class flare from this region. AR3004 continues to rotate further off the visible disk, and is expected to contribute less to the overall flare risk in coming days. On the other hand, there is evidence of a bright region and flare activity close to the northeast limb at present, but risks will be evaluated accordingly when analysis can take place as this region rotates into view.

X Ray Flares Probability	Level	Past 24 Hours (Yes/No)	Day 1 (00-24 UTC) (%)	Day 2 (00-24 UTC) (%)	Day 3 (00-24 UTC) (%)	Day 4 (00-24 UTC) (%)
Active	R1-R2 M Class	Yes	50	50	40	40
Very Active	R3 to R5 X Class	Yes	10	10	10	10

Figure 3: X-ray flare trace past 24 hours



Issued by Met Office Space Weather Advisor, Tel: +44 (0) 330 135 4254 Email: moswoc@metoffice.gov.uk

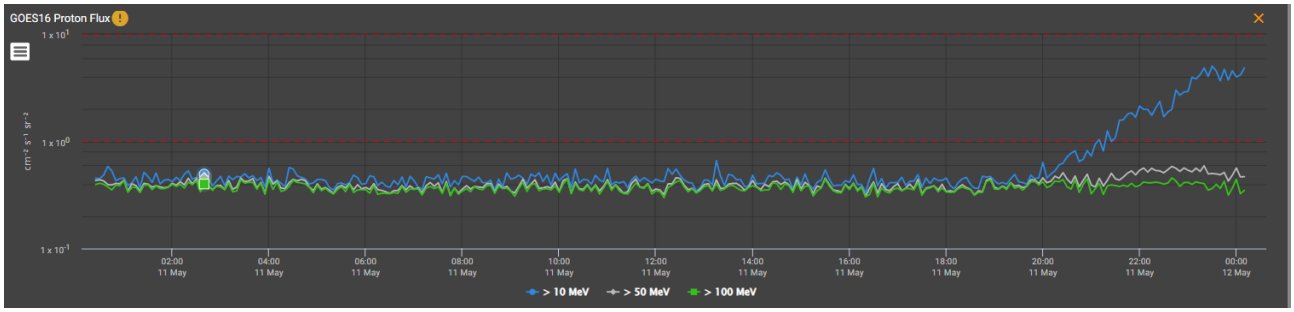
© Crown Copyright 2022. All Rights Reserved.

Solar Radiation Storms - (High Energy Protons):

The high energy proton flux (greater than 10 MeV) as measured by GOES-16 at GEO is currently at moderate levels in response to the M2.6 flare on 11th around the western limb. The proton flux is expected to return gradually back to low background levels. Solar radiation storms are currently not expected over the next 4 days.

Radiation Storms Probability (Exceedance)	Level (cm^{-2} sr^{-1} s^{-1})	Past 24 Hours (Yes/No)	Day 1 (00-24 UTC) (%)	Day 2 (00-24 UTC) (%)	Day 3 (00-24 UTC) (%)	Day 4 (00-24 UTC) (%)
Active	**≥ S1**	No	10	1	1	1
Very Active	**≥ S3 ***	No	1	1	1	1
* S3 ≥ 10 MeV ≥ 1000 pfu and / or ≥ 50 MeV ≥ 10 pfu. (pfu = $cm^{-2}sr^{-1}s^{-1}$)						

Figure 4: GOES16 Proton Flux past 24 hours.



Issued by Met Office Space Weather Advisor, Tel: +44 (0) 330 135 4254 Email: moswoc@metoffice.gov.uk

© Crown Copyright 2022. All Rights Reserved.

High Energy Electrons Event (≥ 2MeV):

High energy electron flux (greater than 2MeV) is expected to be at mainly low background levels through the forecast period with no significant solar winds currently anticipated. Therefore the Electron fluence levels are also expected to remain well below the Active threshold and are not expected to increase significantly at this stage.

GEO Electron Environment Probability (Exceedance)	Level (cm^{-2} sr^{-1} day^{-1})	Past 24 Hours (Yes/No)	Day 1 (00-24 UTC) (%)	Day 2 (00-24 UTC) (%)	Day 3 (00-24 UTC) (%)	Day 4 (00-24 UTC) (%)
Active	**≥ 2 MeV ≥ $1x10^{8}$**	No	1	1	1	1
Very Active	**≥ 2 MeV ≥ $1x10^{9}$**	No	1	1	1	1

Issued by Met Office Space Weather Advisor, Tel: +44 (0) 330 135 4254 Email: moswoc@metoffice.gov.uk

© Crown Copyright 2022. All Rights Reserved.